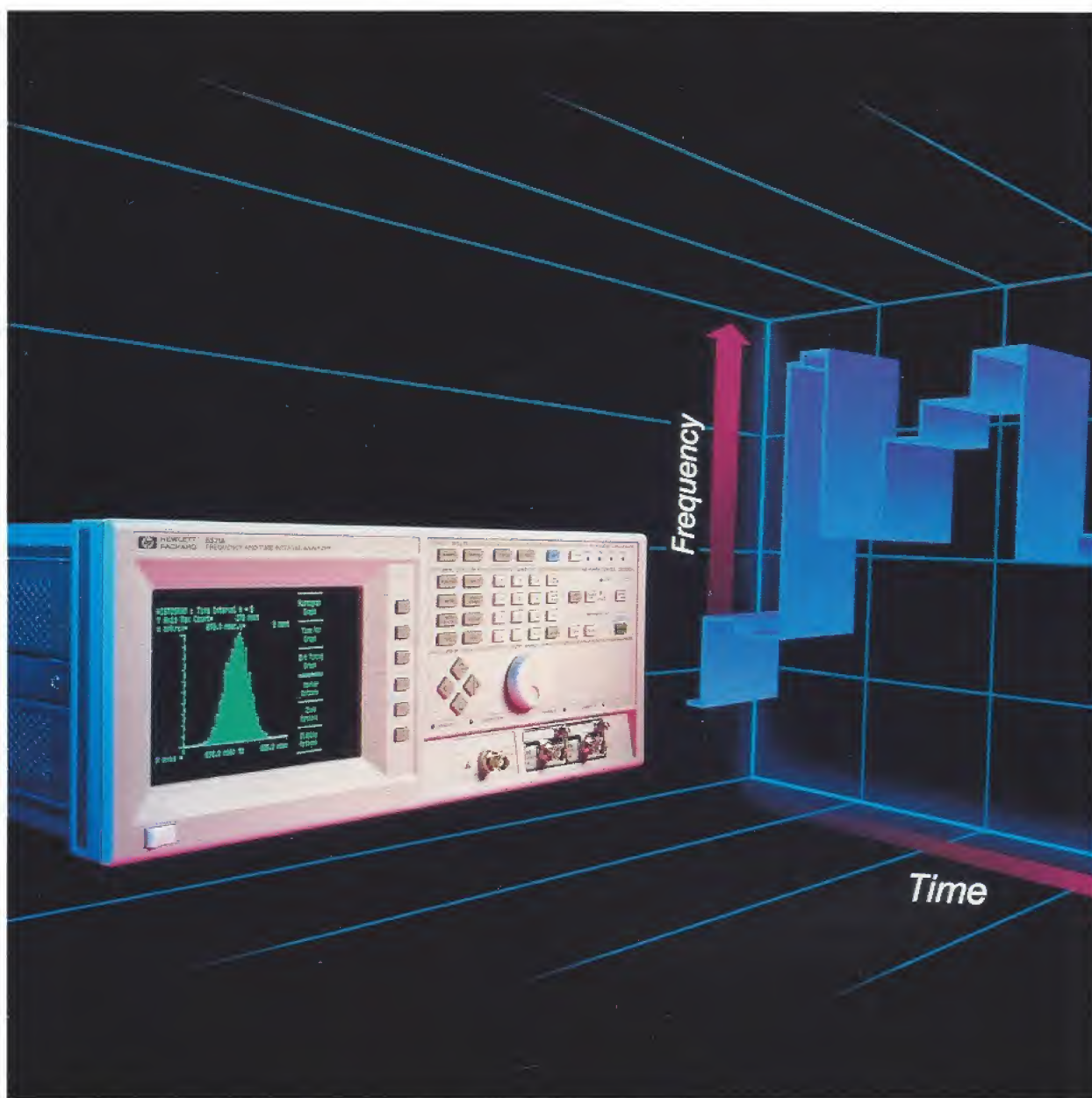


# TEST & MEASUREMENT

N E W S

HEWLETT-PACKARD

JANUARY/FEBRUARY 1988



HP 5371A Frequency and Time-Interval Analyzer

 **HEWLETT  
PACKARD**

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## GENERAL-PURPOSE INSTRUMENTS

## DACQ unit has stand-alone capability

The HP 3852A Data Acquisition/Control Unit can now operate without a computer. With the help of the new HP 44788A HP-IB Controller Module, the HP 3852A can autoboot from an HP-IB disc drive, send data to a disc or a printer, and control other HP-IB instruments.

The new controller module contains its own HP-IB port and can be put into any slot in the HP 3852A. The instrument's processor can control discs, printers, and other instruments on this bus. The standard HP-IB port is still available so that the HP 3852A can be controlled by a computer.

## Output to disc and printer

When using the HP 3852A in a remote location, the HP-IB controller module can log data to a disc without the need for a computer. Data collected by the HP 3852A and stored in its memory can be sent to an HP-IB disc drive via this module. Data can also be retrieved from disc and sent directly to an HP-IB printer without using a computer.

## Controls other instruments

In cases where you need the HP 3852A to control other instruments, the HP-IB controller module gives the HP 3852A that capability. The system price is reduced because a computer is not needed.

The HP 44788A module is \$600. The HP 3852A mainframe is \$3,800.  
*For more information, call your HP Sales Representative.*

## Order Multiprogrammer by May 31, get free keyboard and monitor

The new HP 6954A Multiprogrammer combines an eight-slot card-cage instrument with a standard HP 9000 Model 310 Computer in a single compact, rack-mountable unit. It controls both plug-in instrument cards and up to 14 external HP-IB instruments to form a comprehensive test system. By eliminating the need for a separate computer, the HP 6954A saves you valuable rack space and money.

This addition to HP's family of Multiprogrammers is designed for electronic production test of components, subassemblies, and finished products; for remote-site monitoring; and for use as a transportable test set.

## User-adaptable instrumentation

The Multiprogrammer uses a selection of 30 plug-in instrument cards. You can adapt these cards to your specific application needs by connecting them together in alternative ways to implement stimulus, switching, measurement, and control functions.

By adding an optional keyboard and monitor, you can operate the HP 6954A in a local control mode and use it as a stand-alone program development station with complete access to the internal computer. HP's BASIC 5.0 and the HP 14753A Computer-Aided Test Programming Package are included. Other features include a DMA card for fast transfer of measurement data to the computer, an HP-IB interface for controlling external HP-IB instruments, and an RS-232-C interface.

The internal HP 9000 Model 310 computer is based on a 68010 microprocessor and contains 1M byte of RAM. It includes a 20-Mbyte hard disc that automatically boots and runs HP BASIC 5.0 and can be used for data storage.

The HP 6954A has two card cages:

- One with eight positions for plug-in multiprogrammer instrument I/O cards. This can be expanded to 120 slots by adding up to seven HP 6944A Multiprogrammers as card-cage extenders.
- One within the Model 310, which accepts three additional HP 9000 Series 300 com-

## GENERAL-PURPOSE INSTRUMENTS

puter interface cards. This makes it easy to expand memory and add interfaces.

### Family of plug-in instrumentation cards

The HP 6954A uses the same established family of plug-in I/O cards that are compatible with the HP 6942A, HP 6943A, and HP 6944A Multiprogrammer mainframes. As an example, the many functions and capabilities offered by the family of I/O cards enable the HP 6954A to digitize analog data up to 500 kHz, acquire up to 1 Mbyte of 16-bit data at rates up to 1 MHz, or continuously log data directly to disc at rates up to 200 kHz.

### Special introductory offer

Purchase an HP 6954A before May 31, 1988, and you will receive a free Option 001 Monochrome Monitor and Keyboard. The regular price for Option 001 is \$595. For complete details on this offer and full product information, call 1-800-752-0900, ext. 775A.

The HP 6954A Multiprogrammer is \$10,400. The plug-in instrumentation cards range from \$415 to \$2,350, depending on function. The HP 6944A Multiprogrammer for instrument card-cage extension is \$3,800.

For more information, call 1-800-752-0900, ext. 775A, or check **A** on the HP Reply Card.



You can adapt a selection of 30 plug-in instrument cards to your specific application needs.

## New C-V meter is faster, more accurate



The new HP 4279A C-V Meter makes fast and accurate C-V measurements at 1 MHz for varactor and MOS diodes.

The new HP 4279A 1-MHz C-V Meter increases quality and test throughput of varactor and MOS diodes. The new meter's high accuracy and speed make it an excellent choice for incoming inspection and for production test of components requiring capacitance vs. bias voltage measurements at 1 MHz.

The measurement range of the C-V meter is 0.00001 pF to 1280.00 pF. It has 6-digit

resolution and the basic accuracy is 0.1 percent. The dc voltage sweep accuracy is 1.0 percent throughout its  $\pm 38V$  range, ensuring very low measurement error because of bias voltage uncertainty. The HP 4279A measurement speed is user-selected from 10 ms, 20 ms, and 30 ms per point.

The C-V meter is priced at \$9,700.

For more information, check **B** on the HP Reply Card.

## GENERAL-PURPOSE INSTRUMENTS

# Analyzer provides new insight into frequency and



Pulse width jitter, pulse repetition frequency, chirp linearity, and RF pulse rise time can be measured directly with the HP 5371A to simplify radar system characterization.

The HP 5371A Frequency and Time-Interval Analyzer offers you entirely new ways to capture and analyze dynamic signal information. Using a continuous measurement technology, the analyzer makes it possible to measure deviations in frequency, phase, or time intervals as a function of time. By adding the missing dimension of time to these measurements, a new level of viewing and analyzing signal data becomes available.

## A break with tradition

The HP 5371A is different from traditional frequency counters because it continuously measures the input frequency without stopping between measurements to reset the hardware. The analyzer measures and

"time-tags" continuously as it reads the input frequency, phase, or time intervals. You can make up to 1,000 continuous frequency measurements on signals to 500 MHz with sampling intervals as short as 100 ns. High-speed, continuous measurements time-tagged on the HP 5371A reveal critical signal information that until now was unavailable or difficult to obtain.

## Built-in analysis eases operation

The HP 5371A also provides statistics, histograms, time variation of data, event tim-

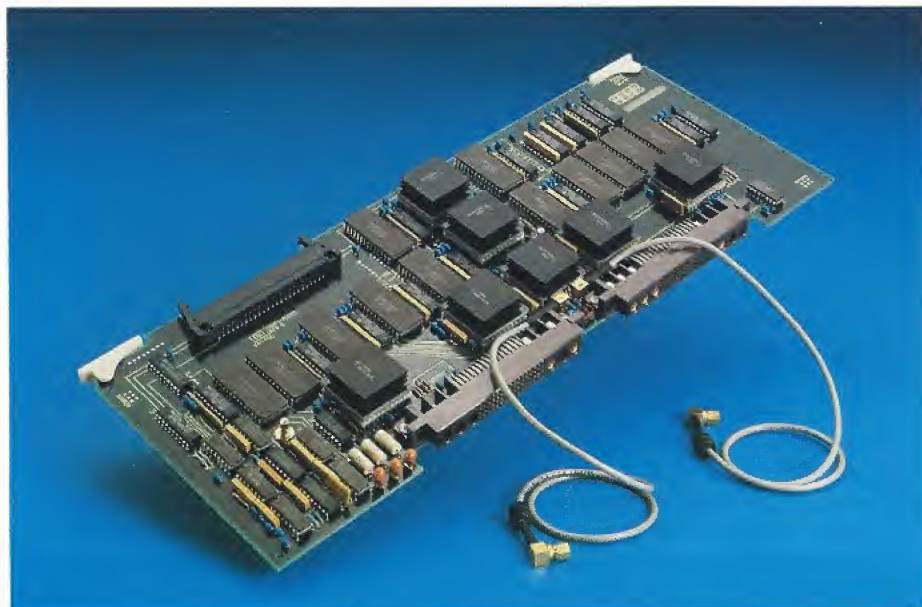
ing, and limit testing of data. These analyses are built in, eliminating the need for additional instrumentation, computers, or complex software. As a result, test costs are lowered and design cycles reduced.

## Measure frequency-agile signals

By adding the dimension of time to frequency measurements, the HP 5371A makes it possible to see the hopping sequence, settling time, and FM or FSK (frequency shift keying) information on an agile carrier. The HP 5371A accurately measures not only the frequency-hopping sequence and switching time directly from displayed informa-

## GENERAL-PURPOSE INSTRUMENTS

## time-interval phenomena



High speed, custom ICs read count totals "on the fly" at rates to 10 MHz for input signals to 500 MHz without interrupting the counting process.

tion, but also uses the histogram technique to verify correct spectrum use.

#### Simplify radar pulse characterization

Built-in statistical computations and graphic display on the HP 5371A simplify radar pulse characterization. Pulse width histograms directly measure a radar's ability to separate closely spaced targets. Similar analysis of pulse repetition frequency measurements indicates the maximum unambiguous range of the radar. The HP 5371A is also an excellent transducer to measure and characterize chirp linearity, which is key to FMR (FM ranging) performance.

#### Directly characterize a VCO

Both transient and steady-state responses of a VCO (voltage-controlled oscillator) can be characterized directly on the HP 5371A. Continuous frequency measurements made at the output of a VCO when the input voltage is stepped provide a direct profile of the

step response of the VCO in a single pass. The Time Variation plot directly displays settling time and post-tuning drift.

#### Analyze frequency stability with Allan variance

Many applications specify frequency stability in the time domain or by Allan variance. Allan variance and root Allan variance ( $\sigma_y$  of  $\tau$ ) are calculated and displayed directly by the HP 5371A along with traditional statistical parameters. Frequency to 500 MHz is measured with zero dead time, ensuring no lost information in the Allan variance calculation.

#### Improve digital communications with jitter and wander analysis

Signal jitter and wander are major sources of concern in the move toward synchronous digital communications networks. With its 150-ps rms single-shot time interval resolution, the HP 5371A provides significant improvements in jitter accuracy by sampling the time of occurrence of data and clock

edges. The HP 5371A lets you measure frequency vs. time, time interval error vs. time, phase vs. time, or root Allan variance.

#### Accurately characterize disc drives

The HP 5371A makes it possible to examine either any single edge or any group of data edges in fine detail to determine the exact cause of problems and ultimately improve the error rate performance of a disc drive. Clock-to-data and data-to-data time jitter can be measured and the results analyzed directly with statistical and graphical analysis. Peak shift and asymmetry characteristics are easily determined with built-in capability.

The HP 5371A Frequency and Time Interval Analyzer is \$21,500. Option W30, offering two additional years of "return-to-HP" service and support, is \$400.

For more information, check **C** on the HP Reply Card.

## GENERAL-PURPOSE INSTRUMENTS

## Instrument Notes

**New HP 35632A provides link.** The HP 35632A provides an optimum link between the HP 3565S Multi-Channel Dynamic Signal Analyzer and structural-analysis software packages from independent software vendors. The combination of HP VISTA measurement software and the HP 3565S gives you a practical method of making multiple input-output frequency-response measurements. The HP 35632A associates frequency-response measurements with measurement name and direction and manages the frequency-response spatial coordinates at each measurement location. The HP 3565S provides up to 63 channels for frequency-response functions and associated ordinary, partial, and multiple-coherence functions. To receive data sheets, check **D** for the HP 35632A, **E** for HP VISTA, and **F** for the HP 3565S.

**Measure pulsed-microwave and millimeter frequencies to 110 GHz.** A new brochure describes how one counter can supply all your frequency measurement needs. The versatile HP 5345A Electronic Counter, with optional HP 5355A Automatic Frequency Converter, HP 5356A/B/C Frequency Converter Heads, and HP 5356D Harmonic Mixer Driver, allows you to customize pulsed and continuous-wave frequency measurements from dc to 110 GHz. The counter's high resolution and accuracy make it well suited for the characterization of radar systems and microwave components. Check **G**.

**Quartz pressure probe and set increase oil/gas well productivity.** The improved HP 2813E Quartz Pressure Probe and HP 2813D Quartz Pressure Set will maximize oil/gas well performance while reducing production costs. Featuring a new mechanical package to withstand severe environmental conditions, the HP 2813E probe prolongs well operation. Improved thermal response shortens test time and delivers accurate pressure mea-

surements quickly, cutting test costs. The probe's high accuracy readings and precise repeatability will give you confidence in your well's pressure measurements. The HP 2813D Quartz Pressure Set allows you to design custom downhole instrumentation packages. Check **H**.

**New plane mirror interferometer.** The new HP 10706B High-Stability Plane Mirror Interferometer increases the measurement and control accuracy, repeatability, and stability of your HP laser position transducer. The HP 10706B is an exact functional replacement for the HP 10706A, and is typically 12 times more thermally stable than conventional plane mirror interferometers such as the HP 10706A. This increased performance is available to you at the same price as the HP 10706A. If you already use the HP 10706A, you can convert it to the HP 10706B with the new HP 10723A High-Stability Adapter at a quarter of the cost of a new interferometer. Check **I**.

**New application note for radar system analysis.** Find out how to use the HP 5185A Waveform Recorder or HP 5185T Digitizing Oscilloscope to capture and analyze single-shot radar system signals. Topics in this application note include automatic, objective analysis of radar pulses; IF acquisition; frequency and phase profiling; and spectrum analysis of radar signals at IF. Check **J**.

## RF &amp; MICROWAVE

## New spectrum analyzer does the job almost anywhere

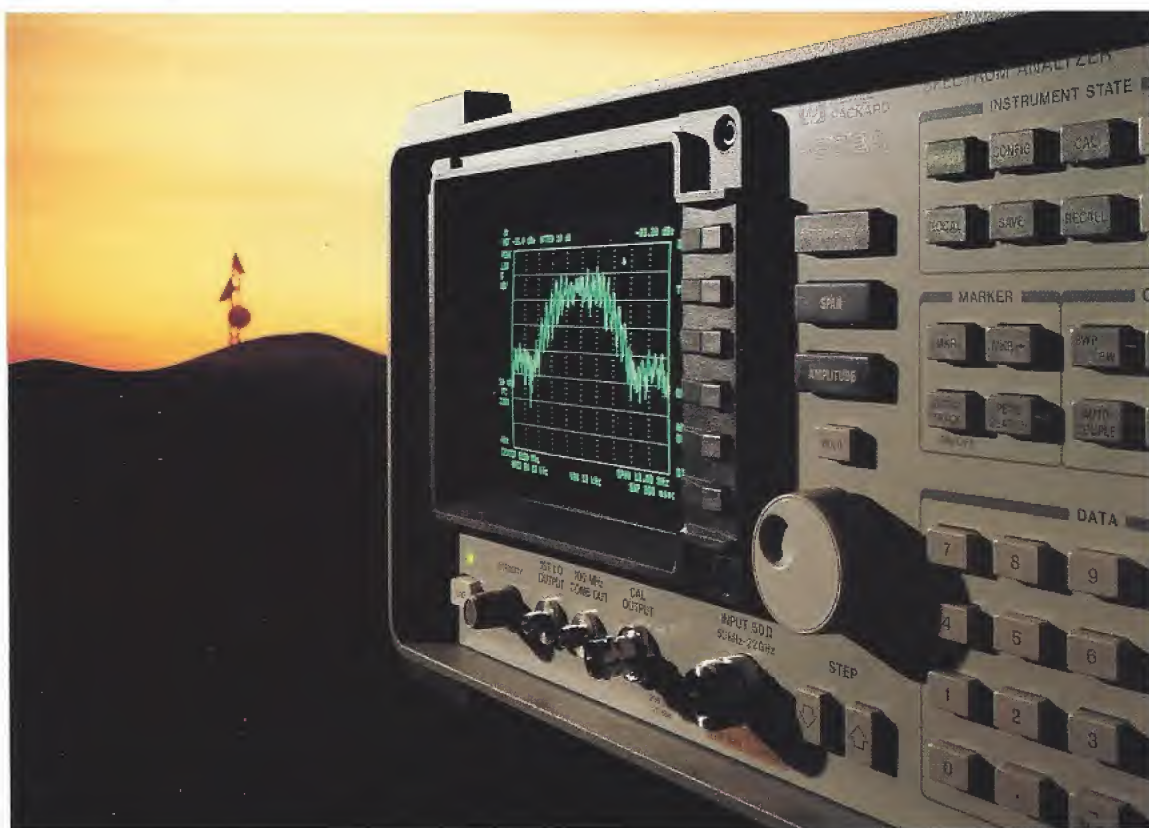
The new HP 8592A Spectrum Analyzer is portable, preselected, fully programmable, and low priced. Its wide frequency range (50 kHz to 22 GHz) and amplitude range (-109 dBm to +30 dBm) let you make almost any RF or microwave measurement that can be made by a spectrum analyzer. Weighing 15 kg (33 lbs), the HP 8592A provides many benefits:

- It is sturdy and compact (21.3 cm × 36.6 cm × 46.0 cm) and has a tilt-bail handle for easy carrying.
- An internal preselector reduces multiple and image responses.
- A built-in comb generator enhances frequency accuracy to  $\pm 2.7$  MHz at 22 GHz.
- Three digital interface options—HP-IB (IEEE 488), HP-IL (Hewlett-Packard Interface Loop), and RS-232-C—provide full programmability.
- Dedicated keys and softkeys enable you to operate the analyzer effectively without a lot of training.
- Self-calibration routines correct for errors, and power-up self tests verify operation.

**What you need—where you need it**

The HP 8592A is well suited for the installation and maintenance of microwave communication equipment. You can align antennas for fixed or mobile microwave communications. Or you can maintain systems in the areas of point-to-point microwave radio, TV auxiliary broadcast, and private operation fixed microwave service. Easy operation, programmability, and direct printer and plotter control make the HP 8592A ideal for ap-

## RF &amp; MICROWAVE



The low-priced HP 8592A is designed for field servicing of communication equipment as well as lab-bench and manufacturing use.

plications in R&D and manufacturing.

#### Accessories add capability

With the HP 11945A Close-Field Probe Set, the HP 8592A can be used by circuit and mechanical designers for identifying sources of electromagnetic radiation and evaluating shielding effectiveness in new-product designs. If a large display is desired for the lab bench or production line, the HP 82913A 12-inch video monitor can be added to the HP 8592A.

For field use, the HP-71B Handheld Computer can be used for more sophisticated data storage. The HP 8592A will output all CRT information directly to an HP ThinkJet or QuietJet printer for hardcopy test data.

#### Increase development speed with analyzer functions

A number of features simplify operation and increase productivity. Signals are cen-

tered, resolved, and moved up and down with three keys.

Internal parameters such as resolution bandwidth, video bandwidth, sweep time and input attenuation are automatically adjusted to maintain a calibrated display.

#### CRT softkey menus access more than 80 additional functions

Marker functions display frequencies and amplitudes for the displayed spectrum (Marker Normal, Next Peak, and Marker Delta), automatically locate the highest amplitude signal on a trace (Peak Search), and keep a drifting signal at the center of the screen (Signal Track). A fast Fourier Transform function enables modulation analysis to tens of Hz from a carrier. Built-in func-

tions find 3 and 6-dB points and 99 percent power bandwidth.

Save/Recall functions store and recall up to nine different analyzer-control settings, and five trace displays can be saved in non-volatile memory. Trace-math functions add, subtract, and exchange positions of traces.

#### Conforms to your needs

A variety of computers can program the analyzer, including HP technical workstations, the HP Vectra PC and IBM PC, and the HP-71B. The HP-71B fits inside an optional front cover and provides automatic measurement capabilities for bench and field use.

The HP 8592A is priced at \$19,950, and each digital-interface option is \$450.

For more information, check **K** on the HP Reply Card.

## RF &amp; MICROWAVE



Now you can calibrate attenuators and signal generators with the HP 8902AT and 8902SG systems, an ability especially useful in service, quality, and metrology departments.

## Systems calibrate signal generators and attenuators automatically

Two system configurations from HP feature new menu-driven software to automate the calibration of signal generators and attenuators.

The HP 8902SG Signal Generator Test System includes the new HP 11808A menu-driven software for testing any brand of signal generator. The HP 8902AT Attenuator Calibration System includes the new HP 11806B software for full automatic calibration of fixed, manual, and programmable attenuators. Both systems use the HP 8902A Measuring Receiver as the key component

and offer 0.005 dB/10 dB level measurement accuracy.

### Test any signal generator

The HP 8902SG system, which also includes the HP 8903B Audio Analyzer, will do performance verification testing on any signal generator from 150 kHz to 26.5 GHz. The time required to make frequency, power, modulation, and audio measurements is reduced from hours to minutes. For example, an HP 8656B that used to take three to four hours to test manually can now be tested in 20 minutes. The operator can halt the system at any time to make adjustments if needed.

The HP 8902SG comes with packages for testing most HP signal generators, and you can add other packages easily with the help of supplied software.

### Automatic attenuation measurements

Using the HP 11806B software package, the HP 8902AT automatically makes attenu-

ation measurements against specifications from 2.5 MHz to 60 GHz. Once data has been taken, you can perform statistical comparisons—average several files, compute the standard deviation, or find the minimum and maximum values.

Depending on the options ordered, the HP 8902SG ranges from \$65,000 to \$130,000. The HP 11808A is \$6,000. The HP 8902AT system is priced depending on the frequency range needed, \$75,000 to \$150,000. The HP 11806B is \$3,000.

For more information, check **L** on the HP Reply Card.

## RF &amp; MICROWAVE

## Signal generator combines frequency agility and spectral purity

The new HP 8645A Agile Signal Generator lets you test both the stringent RF performance and the dynamic fast-hopping capability of frequency agile and surveillance receivers. This new 2060-MHz signal generator combines 15- $\mu$ s switching speed with low phase noise and high-rate, high-deviation modulation.

You can also simulate a complex RF environment to test for susceptibility to interference or use the fast-switching capability to decrease production test time.

### Spectral purity and modulation for receiver measurements

For in-channel measurements, the HP 8645A offers simultaneous FM, AM, and pulse modulation along with less than 2 Hz of residual FM. The HP 8645A can be internally modulated at dc to 400 kHz rates, or externally modulated with 20 MHz of deviation and up to 10 MHz rates. In fast hop mode, maximum deviation is 4 MHz at a 10 MHz rate. AM is available at up to 100 kHz rates and 99% depth.

For adjacent channel measurements, such as selectivity and spurious response, the HP 8645A has specified phase noise to  $-129$  dBc at offsets of 20 kHz or greater. Spurs are more than 100 dB down beyond 20-kHz offsets.

### Frequency agility for dynamic testing

While maintaining spectral purity, the HP 8645A will switch frequencies as fast as 15  $\mu$ s from 128 to 2060 MHz. For 8 to 128 MHz the switching speed is 85  $\mu$ s, and below 8 MHz it is 500  $\mu$ s. You can enter up to 2,400 different frequencies with an accuracy of



The HP 8645A combines spectral purity with 15- $\mu$ s switching speed.

1 Hz per MHz and sequence through 4,000 settings automatically.

The HP 8645A offers flexible control of frequency switching. You can input parameters from the front panel to get up and running quickly, or you can input them remotely, either from a computer using the HP-IB, or from the rear panel using TTL connectors for real-time control. For frequency agile and surveillance receiver testing, you can synchronize the HP 8645A with a transmitter or directly to the receiver. Key parameters such as hop rate, dwell time, amplitude, and frequency can be controlled precisely. The real-time external control of the output frequency means

that the HP 8645A can effectively emulate a follower jammer.

The HP 8645A is \$32,000. Option 001 high-stability frequency reference is priced at \$1,500. Option 002 doubled version to 2060 MHz is \$6,000 and will be available August 1, 1988.

For more information, check **M** on the HP Reply Card.

## RF &amp; MICROWAVE

## Spectrum analyzers now preselected to 26.5 GHz

Two microwave spectrum analyzers now have preselected coverage to 26.5 GHz for your high-frequency bench, ATE, and field portable measurements.

The HP 8562A Option 026 provides this capability for HP's microwave portable spectrum analyzers. The HP 71201A Option 001 does the same for the HP 70000 Modular Spectrum Analyzer family.

The HP 8562A Option 026 is \$3,000, and the HP 71201A Option 001 is \$4,000.

For more information, call your local HP Sales Office.



The HP 8562A Opt. 026 provides preselection for HP's microwave spectrum analyzers.

## Reference literature for microwave applications

Everyone knows that HP publishes mountains of applications literature each year. This table summarizes the last year's output of Application and Product Notes for the RF/Microwave area. Product Notes (PN) are one-product-specific, while Application Notes (AN) are more generic in nature or cover families of products. If you need any of this literature, just call your local HP office.

Title	Literature Number
Measurement Applications for Digital Microwave Radio (AN 343-1)	5954-6365
Coherent Pulsed Tests of Radar and DE Systems (AN 343-3)	5954-6366
Introductory Operating Guide for the HP 8780A Vector Signal Generator (PN 8780A-1)	5954-6368
Introductory Operating Guide for the HP 8980A Vector Analyzer (PN 8980A-1)	5954-6369
Coaxial and Waveguide Measurement Accessories Catalog	5954-6401
Signal Generator Selection Guide	5954-6917
Spectral Purity Characteristics of HP Microwave Signal Sources (AN 329)	5954-8349

Four Steps to Buying an RF/Microwave Power Meter (AN 64-4)	5954-7363	Introductory Operating Guide for the HP 8510B Network Analyzer (PN 8510B-10)	5954-8367
Effective Use of the HP 8770S Signal Simulator System (PN 8770S-2)	5954-6360	Amplitude and Phase Measurements of Frequency-Translating Devices Using the HP 8510B Network Analyzer (PN 8510-7)	5954-8379
Novel Combinations of Microwave Switches and Step Attenuators for Programming Applications (AN 332-1)	5954-8892	Applying the HP 8510B Thru-Reflect-Line (TRL) Calibration to Non-Coaxial Measurements (PN 8510-8)	5954-5382
Introducing the HP 8590A Spectrum Analyzer (PN 8590A-1)	5954-2730	Radar System Characterization and Testing (AN 174-14) SCD	5952-7892
Principles of Microwave Connector Care for Higher Reliability and Better Measurements (AN 326)	5954-1566	How to Use the HP 11970/71 Harmonic Mixers (PN 11970/71-1)	5954-9100
Millimeter-Wave Instrumentation Brochure	5954-1527	Low Phase Noise Applications of the HP 8662/3 Synthesized Signal Generators (AN 283-3)	5953-8435
Exceptionally Complex Signal Simulation for Multi-Signal Environments in Radar/EW Test (AN 314-4)	5952/3702	Measuring Demodulator Image Rejection Using the HP 8980A Vector Analyzer (AN 343-4)	5952-3703
Applications and Operation of the HP 8970B Noise Figure Meter and HP 8970S Microwave Noise Figure Measurement System (PN 8970B/S-2)	5954-8896	Dynamic Range Considerations of the HP 8980A Vector Analyzer (PN 8980A-2)	5952-3704
Amplifier Measurements with a Scalar Network Analyzer (AN 345-1)	5954-1599	Automatic MIL-STD EMI Testing Using the HP 85864A/B EMI Measuring Software (AN 330-1)	5954-2705
Mixer Measurements Using the Scalar Network Analyzer (AN 345-2)	5954-8369	Automatic CISPR EMI Testing for Conducted Emissions Using the HP 85864B/C EMI Measuring Software (AN 331-1)	5954-2724
		Digital Radio Theory and Measurements (AN 355)	5954-9554

## RF &amp; MICROWAVE

## RF/Microwave Notes

**Components.** HP's 1986 announcement of 2.4-mm coaxial connector technology was important news to systems people working up to 50 GHz. We're adding more products for that mm-wave range. HP 8490D and 33340D Coaxial Fixed Attenuators are now available in values of 3, 6, 10, 20, 30, and 40 dB for operation dc to 50 GHz. Their tantalum-nitride load elements are particularly stable with time, and SWRs range from a low of 1.08 to 1.45, depending on frequency and pad value. Check **N**.

When you're responsible for calibration and certification of scalar and vector analyzers, you're looking for fixed and sliding loads with lowest SWR and best repeatability. The HP 909F is a 50-ohm fixed termination with APC-7 connector, and SWR of 1.005 from dc to 5 GHz, 1.01 to 6 GHz. It is also available in Type-N (m) and (f). The thin-film-on-sapphire elements are very stable with time and temperature. Check **O**.

When we introduced the HP Planar-Doped-Barrier detector technology a little over a year ago, we stopped at 26.5 GHz. Now there is the HP R422C Detector, which covers the 26.5 to 40.0 GHz band in WR-28 waveguide. PDB technology beats Schottky diodes hands down. The details are covered in a *Microwave Journal* article in May 1987, "A Planar Doped Barrier Detector for General-Purpose Applications," by HP's Archibald Fraser.

The new HP coaxial sliding loads and mismatches have a novel mechanism that releases the center conductor but can retract it to a precise longitudinal position for outstanding repeatability (< 0.001-inch). HP 911D/E sliding loads operate 3 to 26.5 GHz with APC-3.5 connectors and the HP 911F/G sliding mismatches also cover the same ranges.

Most of you are familiar with the coaxial cables we've used to connect instruments for years. Well, there is better technology now and also a need to connect 26.5 GHz. HP 11500C/Ds are new, smaller diameter cables for 60/150cm and with Type-N connectors for 18 GHz. HP 11500E/F cables cover 26.5 GHz with APC-3.5 (M) connectors.

**Communications test.** Our HP 11736A/B I\*Q Tutor digital-radio training program runs on HP technical computers or IBM PC-compatible computers and models a digital communications system on the display. It simulates tradeoffs such as S/N ratios, bit-error-rates, filter factors, modulation types, and also includes more complex problems such as multipath fade and high power amplifier nonlinearity. The program disc and complete instruction manual is inexpensive and should be considered for the new communications engineer, technician, or even the senior engineer who needs to brush up on modern techniques. Check **P**.

**Network analyzers.** Some people have asked for more flexible test port cables for the HP 8510 Vector Network Analyzers. The HP 85131E/F (3.5 mm) and the HP 85132E/F (7 mm) provide excellent phase stability under daily stress and handle unusual test-module geometries. We warrant them for a full year.

You may have overlooked the HP 85161A Measurement Automation Software during the HP 8510B Vector Network Analyzer introduction. The software offers a simple menu-driven way of making automated measurements from 45 MHz to 26.5 GHz. Anyone using the HP 8510 should find out more about it.

**Signal analyzers.** Measuring the image rejection of vector demodulators of modern microwave systems has involved digital scopes and computer data processing. Application Note 343-4, "Measuring Demodulator Image Rejection using the HP 8980A Vector Analyzer," shows how to make the job easier and more accurate with both a manual and automatic method. Check **Q**.

The HP 8980A Vector Analyzer is an excellent instrument for displaying microwave baseband modulations in time, vector, and constellation modes. Engineers looking for the most accurate quantitative measurements over wide dynamic ranges will want to ask for our latest Product Note 8980A-2, "Dynamic Range Considerations of the HP 8980A Vector Analyzer," to improve their technique. Check **R**.

If you're a circuit designer trying to find interference sources in your new circuit design, take a close look at the Option H51 EMC Diagnostic Personality Module for the HP 8590A Spectrum Analyzer. This low-cost analyzer can now be enhanced to do EMI troubleshooting in conjunction with the HP 11940/41A Close-Field Probes. It's a powerful diagnostic technique to have right on your workbench. More information can be found in the HP 11945A data sheet.

Each HP 8562A/B Spectrum Analyzer now shipped includes operation verification software and a manual that can test 80 percent of the specifications—the program runs in less than an hour. It runs on an HP 9000 Series 200/300 Computer. This is important if you run the cal lab of a company that is committing to the new HP analyzers.

**Digital radio test.** HP instrumentation for testing digital communications radios is described in a new brochure, "Test and Measurement Tools for Design, Production, and Maintenance of Digital Microwave Communications Systems." Check **S**.

**Carrier phase noise.** Service Note 3047A-1 now provides new information on achieving measurement traceability to NBS or other national reference lab for the carrier phase-noise parameter.

**Noise figure meters.** Some of you may not have heard of a new way to measure and generate noise figure and gain circles on the Smith Chart. This is important if you're a designer of microwave amplifiers or mixers. We've had some experience with a programmable variable-impedance noise source made by the ATN Company of Woburn, Massachusetts. Basically, they vary the output impedance of the noise source under computer control and have the software that operates our HP 8970S Noise Figure Measurement System (10 MHz to 18 GHz) to measure and plot both sets of circles. It's an impressive capability. If you're interested, ask us to put you in touch with ATN.

The HP 8970 Noise Figure Meter in its six-year life has demonstrated a 20,000-hour-plus MTBF (mean time between failure). That makes it most reliable for production-line test applications. Interestingly, one element that limits life under certain test conditions is the unintended cycling of the input RF attenuator when connecting multiple test devices. There's an easy way to disable the attenuator—just ask your HP Sales Repre-

## RF &amp; MICROWAVE

sentative for the simple code.

**General measurements.** The technical section at the front of the HP Coaxial and Waveguide Measurements Catalog gives you an up-to-date overview of microwave measurements from vector and scalar impedance through signal analysis and signal simulation to metrology systems. Most of the measurements include recommended equipment lists by model number and frequency band, and other selection guides. In the back of the book, you can find waveguide and flange reference data, as well as a bibliography of 70 recent microwave application notes. Check **T**.

**Training.** There's a new RF/Microwave Seminar Catalog available now that summarizes all the various instrument training courses available for microwave measurements. Ask or write for your copy.

**Signal generators.** We have a two-day training course available for the HP 11776A Waveform Generation Software (now included in the basic price). You'll want to take this course to get the most out of your HP 8770S Signal Simulator System (dc to 50 MHz) when creating powerful test waveforms and multisignal environments. "Computer Skills for Digital Signal Synthesis" can also be ordered as HP 11776A + 24D. Ask your HP Sales Representative.

**Price reductions.** Take advantage of substantially lower prices on the HP 8340B Synthesized Sweeper (10 MHz to 26.5 GHz), from \$65,000 to \$57,500; the HP 8757A Scalar Analyzer, from \$11,000 to \$9,000; and the HP 8656B Signal Generator (0.1 to 990 MHz), from \$6,650 to \$5,950.

**Network analyzers.** Some of you need calibrations of vector network analyzers to be made in compliance with MIL-STD-45662. Our Mountain View Service Center can now certify the HP 85051A/B (7 mm), HP 85053A/B (3.5 mm), and HP 85055A (Type N) verification kits to this important quality-process specification. Your Sales Representative can take care of the matter.

A booklet entitled, "MIL-STD-45622 Service Prices" will keep you informed of the availability of all the calibration services mentioned above. Your Sales Representative can get you a copy.

Give your HP 8660A/C Synthesized Signal Generator a new lease on life. You can get a 10-year support life with an upgrade kit for converting to an HP 8660D. The HP 86606A is a factory-performed upgrade for \$6,750. HP 86607A is the upgrade kit you do yourself for \$4,425.

## COMPUTERS/CONTROLLERS

## Low-cost controllers are flexible and powerful



The PC-305CL HP BASIC controller includes an EGA color display and a 20-Mbyte internal hard disc.

Now you have the flexibility and power of HP's instrumentation BASIC 5.0 and an IBM PC-compatible personal computer in one affordable package.

The PC-305 and new PC-308 systems are five preconfigured instrument controllers based on the new line of HP Vectra personal computers. Their dual-processor design and built-in HP-IB (IEEE 488) interface allow you to move data collected via HP BASIC into popular PC-DOS software applications, such as Lotus® 1-2-3®, for statistical or graphical analysis.

The entry-level PC-305M is based on the new HP Vectra CS PC (8086-compatible). It includes a single 1.44-Mbyte 3½-inch flexible disc drive, HP Language Processor Board (MC68000, HP-IB interface, 512K-byte RAM expandable to 4M bytes), serial/parallel interface, HP BASIC 5.0 in ROM, and a multimode video adapter with monochrome display. Model PC-305ML adds a 20-Mbyte hard disc drive. Model PC-305CL includes a 20-Mbyte hard disc and an en-

hanced color-graphics (EGA) display.

The PC-308ML and PC-308CL are higher-performance models based on the HP Vectra ES/12 PC (12-MHz 80286). They include the same options as the PC-305ML and CL.

Both the PC-305 and the new PC-308 controllers can also run HP Workstation Pascal 3.2 with a software-only option that uses the same HP Language Processor Board as HP BASIC 5.0. All five controller configurations include an installation disc that allows you to bypass Vectra DOS 3.2 and automatically load HP BASIC 5.0.

The PC-305M, PC-305ML, and PC-305CL are priced at \$3,895, \$4,595, and \$5,395, respectively. The PC-308ML is \$5,895, and the PC-308CL is \$6,695.

For more information, check **U** on the HP Reply Card.

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